

# PATENT SPECIFICATION

DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

### Tamper-Indicating Closure

I, ZBISLAW MACIEJ ROEHR, of 6200, S.W. 121st. Street, Miami, Florida, United States of America, a Citizen of the United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to improvements in closures of the so-called tamper-indicating type.

It is an object of this invention to provide a tamper-indicating closure having an annular tamper-indicating skirt that is joined to the annular sidewall of the closure by a series of circumferentially spaced bridges of material that leave radially open arcuate gaps between the side wall and the tamper-indicating skirt except where the two are joined by the bridges, and wherein the container is integrally formed with radially outward projections or tongues that extend through the gaps and prevent initial removal of the closure without rupture of at least some of the bridges. Upon rotation of the closure and container relative to one another incident to opening of the container, the tongues shear the bridges and cause the tamper-indicating skirt to be separated from the remainder of the closure. The remainder portion of the closure may then be withdrawn from the container. Fractured bridges or an absence of the skirt indicates that the closure has been removed or that there has been tampering with the same.

In one form of the invention the container and closure are devoid of screw threads and so may be assembled by merely axially shifting the closure onto the container without rotation of either, the two being held assembled by the presence of the tongues in the gaps. The tongues are sufficiently flexible to allow the closure skirt to pass thereover causing the

tongues to be flexed inwardly; however, as the closure approaches or reaches its final closed position on the container, the tongues will flex back substantially to their initial position to engage in the gaps. In another form of the invention, the closure and a container neck are threaded and the container has outward projections or tongues below the thread. The bridges on the cap are yieldable so as to stretch outwardly within elastic limits to allow the projections to underride the bridges as the closure is threaded onto the container. As the projections move rotationally past the bridges and in axial alignment with the gaps the bridges will flex back to their normal positions, leaving the projections extending through the gaps.

In the formation of a package having an unthreaded container and closure, each of which is of plastic, it has been a practice to hold the two assembled by heat-fusing them at adjacent telescoping surfaces. A further object of this invention is to provide a tamper-indicating closure and container of the type stated which eliminates the need for heat-fusing or otherwise providing for a separate structure and assembly operation for securing the closure onto the container.

The attainment of the above and further objects of this invention will be apparent from the following description taken in conjunction with the accompanying drawing forming a part thereof.

In the drawing:

Fig. 1 is a sectional view of the closure taken along the longitudinal axis thereof and showing the closure mounted on a container;

Fig. 2 is a fragmentary sectional view, on an enlarged scale, taken along line 2—2 of Fig. 1;

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Fig. 3 is a fragmentary sectional view taken along line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken along line 4—4 of Fig. 1;

5 Fig. 5 is a fragmentary sectional view taken along the vertical axis of a modified form of closure embodying the present invention;

10 Fig. 6 is a sectional view, on a reduced scale, taken along line 6—6 of Fig. 5;

Fig. 7 is an enlargement of a portion of Fig. 6; and

Fig. 8 is an enlarged elevational view of a portion of the closure of Figs. 5—7.

15 Referring now in more detail to Figs. 1—4 of the drawing, 1 designates a closure having an end wall 2 and a depending cylindrical sidewall 3. The outer surface of the sidewall 3 is formed with outwardly projecting, circumferentially spaced finger-gripping ribs 5 which extend for the length of the sidewall 3 and which facilitate manipulation of the closure 1. At its lower portion the side wall 3 tapers down to a narrow lower rim or periphery 6, and adjacent to the lower periphery 6 is a cylindrical tamper-indicating skirt 7 which may be coaxial with the sidewall 3. The side wall 3 and skirt 7 are joined by a series of circumferentially spaced frangible bridges 9 of closure material which span the space between the lower periphery 6 and the upper rim or periphery 10 of the skirt 7, leaving radially open arcuate gaps 11 between the sidewall 3 and skirt 7 except where the two are joined by the bridges 9. Each bridge 9 may have a radial thickness that is the same as that of the sidewall 3 at its lower periphery 6 but much less than that of the skirt 7 at its upper periphery 10. Furthermore, each bridge 9 may be tapered so as to have its thinnest section at the periphery 6. In the form of the invention herein shown there are eight equally spaced bridges, being each located adjacent to one of the ribs 5, but it will be understood that the invention is not limited to the precise number of bridges 9 herein shown.

20 The closure 1 is molded as a one-piece member. This may be done with conventional apparatus or preferably with apparatus of the general type shown in British specifications 1,088,527 and 1,134,893. The plastic used is preferably a polyolefin, such as polyethylene or polypropylene, but other plastics, such as high-impact strength polystyrene, may be used.

25 One form of container 13 with which the closure cap 1 may be used has an annular end portion 14 that defines an opening 15 into the container. The end wall 2 is disposed across the opening and may seat against the end portion 14. The end portion 14 preferably has an outer cylindrical wall 17 that telescopes within the closure sidewall 3 and the latter may have axially spaced circular

sealing ribs 18 that engage the wall 17. Remote from the container opening 15 the container 13 may have an inwardly extending shoulder 19, and at the radially inner edge thereof a tubular portion 21 of smaller diameter than that of the end portion 14. A container 13 of the foregoing shape with the widened end portion 14 may be suitable where the product to be housed therein is a syringe, although it should be understood that containers having other shapes may be used with the closure 1.

Integrally formed on the end portion 14 at or near the shoulder 19 are circumferentially spaced tongues 23 which project radially outwardly of the end portion 14 and through the gaps 11 to lie radially outwardly beyond the bridges 9. As best seen in Fig. 2, the tongue 23 may be rectangular in cross section with the longer dimension being in the circumferential or horizontal direction and the shorter dimension being in the axial or vertical direction. Four equally spaced tongues 23 are illustrated but a greater or lesser number of them might be used. These tongues 23 prevent separation of the closure 1 and container end portion 14 without fracture of the bridges 9. Thus, a fracture of all of the bridge will cause the skirt 7 to separate from the main body of the closure 1, and will indicate tampering with the closure. Tampering may also be indicated by a fracture of one or more of the bridges 9.

30 When it is desired to remove the closure 1 from the container 13, the two are twisted relative to one another causing the edges of the tongues 23 to shear the bridges 9 and separate the skirt 7 from the main body of the closure, which may then be withdrawn from the container end 14. The closure minus the skirt 7 may be reused as an ordinary cap. Because the tongues 23 are relatively long in the circumferential direction, they present relatively strong and rigid members against the bridges 9 to facilitate rupturing them easily.

35 With four equally spaced tongues 23 and eight equally spaced bridges 9, all of the bridges 9 will be broken after a one-quarter turn of the closure. One group of four bridges will first be broken, followed by the remaining four. However, a different sequence of severance may be created by the use of unequally spaced bridges or unequally spaced tongues, or a combination of both, depending upon the sequence of bridge breakage desired.

40 The closure 1 may be mounted onto the container 13 by axially telescoping the side wall 3 over the end portion 14 without the necessity of having to rotate either. As the conical surface 25 on the skirt 7 meets interference with the tongues 23, the skirt 7 may yield somewhat but the tongues 23 will bend within their elastic limits inwardly (downwardly as viewed from Fig. 1) to allow the

skirt 7 to pass thereby. As the closure axially approaches its final closed position, the tongues 23 will then spring back to their original positions and project loosely through the gaps 11. Because each tongue 23 is relatively thin in its axial dimension, it may be easily flexed by the skirt 7. Nevertheless, the relatively large circumferential dimension of each tongue 23 results in its being fairly rigid when it imposes force on a bridge 9.

So that the tongues 23 will have the desired resiliency within elastic limits for the foregoing purposes, the container 13 should be of a relatively resilient material. Plastics of the polyolefin type, such as polypropylene or polyethylene, are suitable for molding of the container 13. To enhance their flexibility, the tongues 23 may be thinned out where they are joined to the end portion 14.

Desirably, the closure and container will be oriented immediately prior to assembly so that upon axial telescoping of the two the tongues 23 will be circumferentially offset from the bridges 9; otherwise the tongues 23 will end up lodged behind the bridges 9 and will be prevented from snapping into the gaps 11. However, where there is no predetermined orientation, the closure may have unequally spaced bridges 9 and/or the container may have unequally spaced tongues 23 designed such that regardless of the orientation of the closure and container only one tongue would be lodged behind a bridge. Such a condition would not impede the fracture of the bridges upon initial removal of the closure although more rotation of the closure will be required than would be the case if all of the tongues were in the gaps 11.

If a severance of all of the bridges 9 and a subsequent complete separation of the skirt is not desired, it is possible to mold the closure with one of the bridges located so that it is not severed by a tongue. Such a bridge might be one that is radially outwardly of all of the others so that it is not engaged and cut by any one of the tongues. An arrangement of this type would avoid the necessity of discarding the skirt as a separate piece but would still indicate tampering by the fracture of the other bridges.

Figs. 5—8 show another form of the invention in which like reference characters followed by "a" denote parts corresponding to the parts of the container and closure of Figs. 1—4. As best seen in Fig. 5, the closure 1a has a cylindrical side-wall 3a with an internal helical thread 25 and a compressible sealing disc 16. A bottle 13a or like container has an annular end portion or neck 14a with a matching external helical thread 26 for threadedly receiving the closure 1a. The upper periphery 10a of the tamper-indicating skirt 7a is attached to the lower periphery 6a of the closure side wall 3a by circumferentially spaced bridges 9a of plastics closure material.

As seen in Fig. 5, the bridges 9a may be molded so that they bow radially inwardly.

Integrally formed on the container 13a below the thread 26 is an annular radially outwardly extending bead 28, which may be the transfer ring of the container. The bead 28 has diametrically opposed tongues or projections 30, 30 which extend radially beyond the normal diameter of the bead 28. These projections are relatively rigid in the circumferential direction and are generally hook-shaped, opening in a clockwise direction as viewed from Fig. 6. If the container 13a is a blow-molded plastics bottle, the peaks of the projections may lie along the parting line of the mold parts.

The diameter across the peaks of the projections 30, 30 is, of course, greater than the outer diameter of the skirt 7a so that when the closure 1a is screw-threaded onto the container neck 14a, to close the opening 15a, the projections 30, 30 will extend through the gaps 11a. In the clockwise threading of the closure onto the neck 14a, the lower or free end of the skirt 7a interferes with the projections 30, 30. Upon further threading together of the closure and neck, the skirt 7a resiliently deforms into an oval shape to clear the peaks or apexes of the projections 30, 30 and thereafter returns substantially to its originally molded shape. As the projections 30, 30 pass over the bridges 9a, the latter will also yield by bowing radially outwardly but will return substantially to their normal molded positions after the projections 30, 30 have passed thereby and become positioned in the gaps 11a. By proper choice of plastic for the closure 1a, the resilient yielding of the skirt 7a and bridges 9a without breaking of any of them is possible. Polyolefin plastics, such as polypropylene and polyethylene, are suitable for this purpose.

In initially unscrewing the closure from the container neck, the hook-like projections 30, 30 will engage the bridges 9a at their slanted sides 31, shearing the bridges 9a generally at the surface 6a. This causes the skirt 7a to be separated from the remainder of the closure and indicate tampering or previous removal of the closure from the container. The closure may thereafter be used with the container as an ordinary screw cap.

In one form of the structure of Figs. 5—8 the closure 1a may be of the twenty-eight millimeter size, in which case the diameter between peaks of the projections 30, 30 may be about 1.250 inches. The normal outer diameter of the bead 28 remote from said projections may be about 1.050 inches and the minimum in the diameter of the skirt 7a may be about 1.140 inches. With a standard six-pitch thread and a closure having eight bridges, the maximum rotation needed for separation of the skirt 7a is one-hundred-eighty degrees with a 0.83 axial movement of

the closure relative to the container neck. Normally, the axial width of each gap 11a should be .083 inches plus twice the thickness of the projections 30, 30 or about .183 inches. However, by the time the last two unbroken bridges contact the projections during the removal operation, the skirt 7a will yield downwardly so that gaps 11a of about .125 inches should ordinarily be sufficient.

The container 13a may be produced by a two-stage molding process in which the neck portion with the thread 6 and projections 30, 30 are injection molded with a tubular body portion attached thereto. Then while the molded piece is still hot the tubular body portion is transferred to a second mold and blow molded. Such a process provides accurate dimensional tolerances for the neck of the bottle, especially as concerns the projections 30, 30.

The precise construction herein shown is illustrative of the principles of the invention.

#### WHAT I CLAIM IS:—

1. In combination with a container having an opening, a tamper-indicating closure for said opening, said closure comprising a wall, a skirt adjacent to one end of said wall and having a peripheral portion spaced from an adjacent peripheral portion of said wall, said peripheral portions being joined by circumferentially spaced bridges of material that span the space between said peripheral portions, said wall and skirt being telescoped with a part of said container, and means projecting from said container part and through the space between said peripheral portions an amount sufficient to prevent separation of

the closure and container without rupture of the closure at said bridges, said closure and container part being relatively rotatable initially to break less than all of the bridges by said projecting means and then further rotatable to break at least one additional bridge.

2. A combination according to claim 1 in which said bridges are sufficiently yieldable within their elastic limits to permit said projecting means to pass thereby upon assembly of the closure and container.

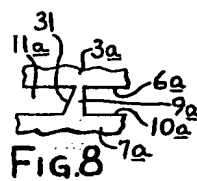
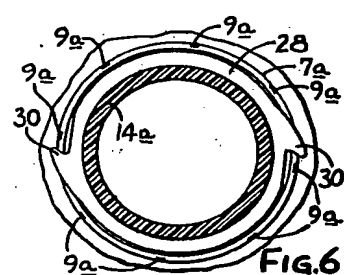
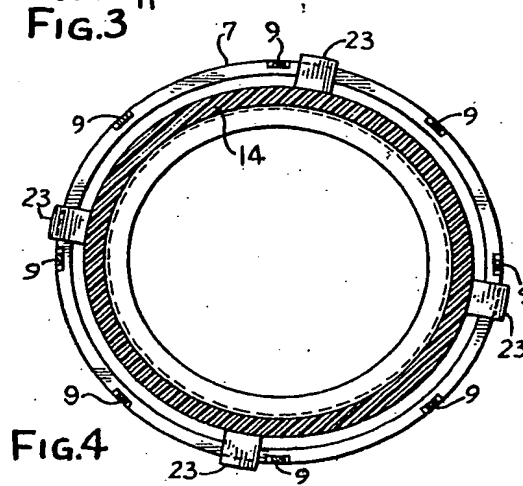
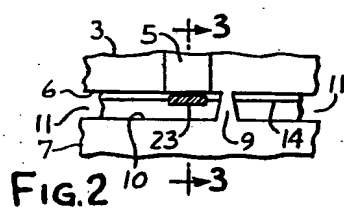
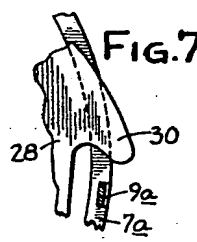
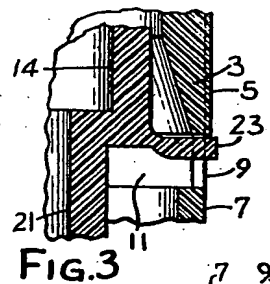
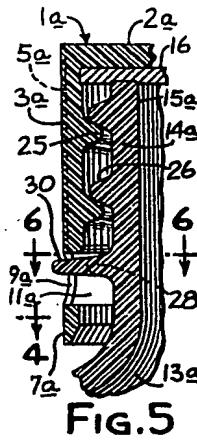
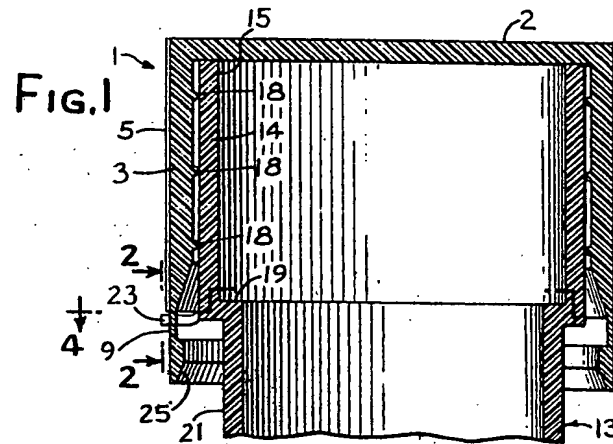
3. A combination according to claim 1 in which said projecting means are sufficiently yieldable within elastic limits to yield as the skirt passes thereover upon assembly of the closure and container and then to reflex and engage in said space.

4. A combination according to claim 1 or 2 in which said closure and container are threaded together and said means comprises tongues that are hook-shaped with the hooks opening in directions to engage bridges upon unthreading the closure from the container.

5. A combination according to any one of claims 1—4 in which said projecting means comprises tongues that are spaced from adjacent bridges so that the closure and container are first relatively rotatable to cause tongue and bridge engagement and then are further rotated to shear the bridges by said tongues.

6. A tamper indicating closure for containers substantially as hereindescribed, with reference to the accompanying drawings.

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